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SCIENTIFIC AND TECHNICAL CONFERENCE OF THE INSTITUTE OF ELECTROMECHANICS

By

N. V. Vartan'yan

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The June, 1969, Scientific and Technological Conference of the Institute of Electromechanics in Leningrad was organized in the following sections and subsections: a section on large electric machines with four subsections on 1. magnetic fields, loss parameters and heating problems; 2. ventilation problems, 3. problems of mechanical calculations, and 4. electric machine diode systems with frequency control, and synchronous compensators; a section of DC machines; a section on systems for excitation of synchronous machines and static power converters; a technical and economic section; a section on low power electric machines; a section on quality and reliability; a section on cryogenic electrical engineering equipment and MHD devices with two subsections on 1. cryogenic equipment and 2. low temperature plasma generators and high current arc generators. In the sections and subsections, 141 papers and 63 reports were heard from members of the institute and workers in a number of other organizations with which the institute is involved in joint research. In addition, a number of reports were made by representatives of other organizations. The titles of some of the papers are given together with brief mention of their contents.		

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## CHRONICLE

### SCIENCE AND TECHNOLOGICAL CONFERENCE OF THE INSTITUTE OF ELECTROMECHANICS

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Eng. N V Vartan'yan

In June in Leningrad there took place a Science and Technological Conference, devoted to the total scientific research activity of the IEM for 1969.

In the operation of the Conference there were admitted participation of approximately 500 scientific workers, engineers and representatives of 87 scientific organizations and enterprises from 43 cities of the country.

In the plenary session addresses were heard from Doctor of Eng. Sci. Prof. L F Gnedin, Candidate of Eng. Sci. Ya P Danilevich, Cand. Eng. Sci. L Ya Stanislavskyy and Engineer Yu V Aroshidze "Turboelectric Generators of large capacity at 1500 revs/min and the basic scientific technological problems associated with their creation", Doctor of Eng. Sci. Prof. V V Khrushchev "Prospects of the application of electronic semiconductors in electrical micromachinery", Cand. Eng. Sci. V A Kozhevnikov "Parameters of a new series of P 2 constant current machines with technical indicators for the 1980 level for regulated electric drive" and Doctor Eng. Sci. L T Ponomarev, "Paths of evolution of insulation of electrical machines".

The work of the Conference took place in the following sections and subsections:

#### Section of large scale electrical machines

- Subsection I Magnetic fields, parameters of loss, questions of heating.
- Subsection II Questions of ventilation
- Subsection III Questions of mechanical design
- Subsection IV Electrical machine rectifier systems, with frequency control and synchronous compensators.

Section of constant current machines.

Section of the systems of excitation of synchronous machines and the high power transformers.

Section of technology economics

Section of the electrical machines of small power.

Section of quality and reliability.

Section of cryogenics of electrical technology equipment and MHD devices.

Subsection I Cryogenic equipment.

Subsection II Generators of low temperature plasmas and of high-current arcs.

In the sections and subsections, in agreement with the operation program of the Conference, there were heard 141 reports and 63 communications, both from workers of the Institute and workers of a series of other organizations, with which are conducted combined works. A series of additional communications were also made by representatives of other organizations, the Scientific Research Institute, the Leningrad Electrical Engineering Organization, "Electrical Power" (Eng. Shifrina) in that "Investigation of the distribution of gas in the radial channels of the core of a stator of a turbo-generator". Tashkent State Radio and Electronic Plant (Eng. U. S. Khashimov) "Investigation of the heating of the winding of the stator of turbo-generator TVV-150-2 with outlined loading (unsteady regime)" and others.

In the section of large scale electrical machines and its subsections, papers were heard on the questions of investigations of electromagnetic fields, of parameters, of losses and the processes of turbo- and hydro-generators, containing the results of calculated and theoretical investigations, experiments performed on models and directly at the installation of the generators.

There was produced the greatest interest of the papers of Cand. Eng. Sci. V V Dombrovskyy and Eng. A K Znesina in which is stated the method of computation of saturation with the aid of semi-conducting paper with calculations of the processes of explicit polar machines, Doctor Eng. Sci. Prof. E Ya Kazovskyy, Eng. I G Lerner, Eng. L I Shmonina, containing the method of investigation of electromagnetic fields with the aid of sinusoidal coils, laid in the gap of a synchronous machine, Doctor Eng. Sci. Prof. E Ya Kazovskyy, and Cand. Eng. Sci. G V Rubisov, Eng. V B Kaplunov, considering the results of the calculated and experimental investigations of a turbogenerator of type TGV-300 with a sudden series (two phase short circuit) short circuit as a transformer and a paper of Eng. V V Ivanova, Eng. I G Lerner, Eng. L I Ryatte, Eng. A A Chistyskov, Eng. I I Yudin in which are presented the results of experimental investigations of the fields in the zone of the frontal part of a hydro-generator, performed in the Krasnoyarsk hydroelectric power plant, and, having been determined on the basis of these investigations, the rating, by means of the electrodynamic forces acting on the front parts of the winding of the stator.

Discussion of these papers indicated that the works are accomplished at a high scientific-technological level and are devoted to basic questions of an

advanced technical level and of operational reliability of high power turbo- and hydro-generators.

Several papers were devoted to the calculations of frequencies of the natural oscillations of the frontal arcs of the windings of the stators of high power hydrogenerators (Cand. Eng. Sci. A A Karymov, Cand. Phys. Math. and Sci. T V Kharitonova), of the oscillations of the core of the stator of a turbogenerator (Cand. Eng. Sci. V N Ravinovich, Plant 'Electric Traction'), of stresses and translations in a two layer hoop ring under the action of fitting forces (Eng. Yu F Khozikov), of forced oscillations and self oscillations of turbomachine rotors on the slip bearings (Cand. Eng. Sci. V A Agafonov). The results of experimental investigations on the determination of the stiffness of shafts in relation to the applied load, the lengths of the shafts investigated and the temperature regimes were discussed in the paper "Mechanical characteristics of shafts of a hydrogenerator of type CVF 1690/75-64" (Cand. Eng. Sci. T Yu Bashenova, Eng. V V Ivanov, Eng. V N Logansen, Eng. A A Chistyakov).

A series of papers was devoted to the frequency control by synchronous and asynchronous motors with the aid of thyristor transformers for a frequency from a network of 50 hertz and in systems with an autonomous generator (Eng. Ya I Aliev, Eng. A S Kozyaruk, Eng. T O Dzhanshiyeva), and also reports were made by Eng. C F Cshchepkobyy "Experimental investigation of the damping regime of an asynchronous motor with a supply from a thyristor transformation of frequency" and by Cand. Eng. Sci. V N Levinyy, Eng. V V Kolesnikovyy, Eng. A A Rakidovyy "Stabilized static constant current transformers with power take off in alternating and constant current".

There were heard with great attention the papers of Doctor Eng. Sci. Prof. I Ya Kazovskyy, Cand. Eng. Sci. D O Troyanska "The transient process in an asynchronous motor with a sudden variation of frequency of supply from a source of comparatively small power" and Eng. M Z Zhelonova "Design of optimal short circuited asynchronous motors of elevated frequency with the aid of a digital computer".

An interesting paper was done by Cand. Eng. Sci. L A Sukhanovyy, Eng. V F Gryzlova, Eng. G P Redkova "Analysis of the basic technical parameters and the problems of design of synchronous compensators with complete water cooling power up to 350 Kw".

With useful information about the structural properties and parameters of synchronous compensators of leading foreign firms was the address of Eng. G P Redkov; with interest also was the report of Doctor Eng. Sci. I N Postnikov, Eng. V P Kuyevda (Institute of Electrodynamics, Acad. Sci. USSR) "Analysis of electrical parameters of flow switched magneto-generators with a core stator".

In the section of constant current machines there were heard 6 papers and 7 communications. The papers "Principle properties of construction of

the new series P 2" ( Assoc. Memb. Acad. Sci. USSR A V Alekseyev, Eng. G Z Amos, Eng. I A Volkovskyy) " Basic trends of development of the technology of manufacture of the P 2 series of motors, providing increase of reliability, of accuracy of manufacture, and a reduction of labor costs" (Eng. M A Kreynes, Eng. G B L'vovich, Eng. A P Yakovlev) and others were devoted to works of the creation of a new series of constant current machines P 2. In the proceedings totals were supplied of the work of the Institute and of the Organizations and Enterprises combined with them, for the development of the new series of P 2 machines. The section noted the depth of the conducted investigations and admitted a series of recommendations, connected with subsequent investigations and experimental construction developments, in the creation of the new series of constant current machines. P 2.

In the section there was heard a group of other papers devoted to constant current machines of great power. Eng. G Z Amos made an interesting communication on the unification of technical level criteria for large scale constant current machines. With great attention there was heard the paper of Eng. G G Borzov, Eng. L I Baylova " Prospects of increased techno-economic properties of constant current machines on the basis of application of superconductors".

In the section of the systems of excitation of synchronous machines and of high power static transformers, there were reported the results of investigations of electromagnetic processes in high power static transformers for various regimes of work. The interest of the audience was effected for the the papers "The influence of asymmetry of stress on the spectral composition of harmonics of the current of three phase bridge transformers" ( Cand. Eng. Sci. A V Emel'yanov) "A comparison of various schemes of two-bridge transformers for units with artificial commutation" (Doctor Eng. Sci. S A Glinternik, Eng. Yu A Ushakov) in the communication " On the feasibility of a resonant filter on the basic non-canonical (third) harmonic of alternating current for an inversion substation" (Doctor Eng. Sci. S R Glinternik, Cand. Eng. Sci. V V Kishayev, Eng. V A Rodinov).

There was heard a pitky paper of Doctor Eng. Sci. Prof. I A Glebov, Cand. Eng. Sci. V G Biryulev, Eng. E N Popov, Eng. N A Smirnitskyy, Eng. V M Bobrov, Eng. V L Golubtsov " The results of investigations and trials in the conditions of operation of an experimental-industrial model of thyristor systems of self-excitation with series transformers for turbogenerators of 200 Mw power!"

A group of papers was devoted to the results of theoretical investigations of the work properties and to calculation of the short circuit currents of a generator with parallel self-excitation (Eng. V Savchenko, Eng. L B Kutkovskiy), to the means of control by mode of a power system according to its system parameters ( Cand. Eng. Sci. V V Semenov, Cand. Eng. Sci. E F Steprura, Eng. V N Fedorov), to the study of the work properties and the transient processes of the brushless system of excitation of synchronous machines (Eng. V K Vorobey, Doctor Eng. Sci. Prof. I A Glebov, Cand. Eng. Sci. V F -4-

Fedorov, Eng. B L Ermilov, Eng. M A Korneyeva and others)

In the paper of Cand. Eng. Sci. V V Dombroskyy, Cand. Eng. Sci. S I Loginov, Eng. A P Andrianov, Eng. Yu V Volchenkova are discussed features of the work of combined alternating current generators, utilized in systems of excitation. A comparative estimate of different systems of excitation of generators, according to the restrictions of dynamic stability are presented in the paper of Eng. E M Kachurina, Cand. Eng. Sci. V S Kostelyants, Eng. L B Rutkovskyy.

In the techno-economic section there was discussed a great range of questions according to forecasts of development of the branch, to the determination of the economic effectiveness of new types of turbogenerators, to the trends of development of the electrical circuits of power systems. These questions are exposed in the papers " Systematic questions of forecast of development of the branch" (Cand. Eng. Sci. E R Sivakov) "Trends of development of electrical circuits of power systems and dynamic stability of high power generators (Cand. Eng. Sci. G E Burtsev, Eng. V V Vyrvinskiy, Eng. L I Durganov), "Economic effectiveness of a reduction of synchronous and transient reactance of heavy duty turbogenerators".

A series of papers was devoted to questions of the techno-economic effectiveness of synchronous compensators and systems of excitation of generators (Cand. Eng. Sci. G E Burtsev, Doctor Eng. Sci. Prof. I A Glebov, Eng. E P Zakharov, Eng. Z B lieyman). Questions were discussed of the determination of the costs of electrical machines and questions of export (Cand. Eng. Sci. L N Davydov, Eng. L N Solov'yev). A group of papers covered questions of planning of the work of the enterprise of heavy electrical machine construction.

In the section of small electrical machines there were heard papers and contributions according to three directions; further development of the theory of well known types of machines (papers of Doctor Eng. Sci. V V Khrushchev, Eng. V M Gandshu, Cand. Eng. Sci. E D Nesgovorova and others); investigations of new types of machines (papers of Cand. Eng. Sci. T E Ovchinnikov, Cand. Eng. Sci. N I Lebedev, Cand. Eng. Sci. P Yu Kaasik, Eng. V V Putnikov and others); trial and monitoring of the quality of electrical motors of small power (paper of Eng. R G Sarkisyan, Eng. V V Gletov, Eng. S V Golub', Cand. Eng. Sci. V A Prozorov and others).

Great interest was produced for the papers of non-contacting constant current electric motors "On the design of non-contacting constant current motors with power less than one watt. (Cand. Eng. Sci. I E Ovchinnikov, Cand. Eng. Sci. N I Lebedev, Eng. Yu V Flatonov) " New solutions for reversing non-contacting constant current tachogenerators" (Eng. V V. utnikov, Eng. V S Rybakov, Eng. A V Slesarev), " Consideration of the influence of restrictions of magnetization of a constant magnet and the restrictions of assembly in the design of non-contacting constant current motors (Cand. Eng. Sci. I E Ovchinnikov, Eng. S A Belyayeva).

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In the section of quality and reliability there were heard papers according to the following directions; 1) Analysis of the operational reliability of heavy duty turbogenerators by the use of a digital computer. 2) Accelerated trials of separate units and elements of electrical machines, 3) Questions of the calculation method of the reliability of elements of electrical machines. 4) Questions of the effectiveness of the introduction of a system of non-defective planning and non-defective manufacture of production.

Especially great interest was produced for the paper of Eng. V I Savina and Eng. A A Chalov "Analysis of the operational reliability of heavy duty turbogenerators" in which is discussed the method of processing, on a digital computer, of the statistical data for the operational reliability of turbogenerators with a power of 200 and 300 Mw, and there is presented an analysis of the derived results.

The contribution "Effectiveness of the introduction of a system of non-defective planning and non-defective manufacture of production (SBIP) on the Enterprises" ( Eng. I P Polyshkin, Eng. G L Kozhedub) produced a lively discussion.

The work of the section of cryogenic electrotechnology equipment and MHD devices took place in two subsections. The session of the subsection of cryogenic equipment was conducted jointly with the Office of Science and Technology (NTS) of the Soviet Ministry of the Electrical Technology Industry. In the subsection there was heard a great quantity of papers according to the state of the tasks in a series of organizations for the questions under consideration, there was extended the decision of the NTS Office for the further direction of these works and their intensification.

Central in the subsection was the paper of Doctor Eng. Sci. Prof. L P Gredin, Doctor Eng. Sci. Prof. I A Glebov, and Cand. Eng. Sci. V G Novitskyy "State of the works and views of application of cryogenic technology and superconducting materials in electrical technology".

There were heard with great attention and interest the papers "Development of a cryogenic turbogenerator of power 30 Mw" (Cand. Eng. Sci. V V Dombrovskiy, Eng. N N Anempodistova), "Some questions of design of cryo-turbogenerators" (Cand. Eng. Sci. V G Dan'ko), "Experimental investigations of a commutator constant current machine without magnetic conductor with super-conducting excitation winding" and others.

The second subsection was devoted to generators of low temperature plasma and high current arcs.

The subjects, of the questions being discussed, touched on the generation of powerful impulsive streams of plasma, investigation of stationary plasmations, electrical sources of supply, the character of combustion of the arcs and methods of diagnostics.

In the paper of Eng. B P Levchenko and Cand. Eng. Sci. F G Rutberga "Investigation of an impulse generator of plasma of great power" there were exposed questions of the work of the impulsive plasmatron, intended for the production of high intensity streams of plasma.

The paper of Cand. Phys. Math. Sci. A N Berezkin was devoted to the heating of Helium in an electrical discharge chamber with the aid of a spark discharge by a capacitor bank.

To the question of the investigation of a plasmatron with rising volt-ampere characteristics of the arc, there was devoted the paper of Eng. A S An'shakov, Assoc. Memb. Acad. Sci. USSR N F Zhukov, Eng. M I Sazonov, and Eng. A N Timochevskyy. The communication of A A Kisleb and Cand. Eng. Sci. F G Rutberg was devoted to an experiment of operation of a three phase plasmatron arrangement, intended for work in the prolonged regimes. In the paper of Doctor Eng. Sci. L A Brichkin, Eng. Yu V Darinskyy, and Eng. L M Pustyl'nikov, there were considered questions connected with heat exchange on the electrodes of a plasmatron. In a series of papers and communications there were considered the methods of diagnostics of dense plasma.

Discussions developed for the accomplished papers. The statements were devoted to questions of calculation of high current arc discharges and also to the estimation of parameters of the devices considered, to the character of the processes originating in powerful arc devices and to questions connected with the diagnostics of a dense plasma.

One of the sessions of the subsection was devoted to the energy power supply of high power arc devices. These questions were considered in the paper of Doctor Eng. Sci. Prof. L P Gnedin, Cand. Eng. Sci. R G Novitskyy, Cand. Eng. Sci. F G Rutberg, by devotion to the state of the question, and the paper of Cand. Eng. Sci. E J Kasharskyy, Cand. Eng. Sci. F G Rutberg, having examined the questions of a shock generator regime with a power supply of high power arcs, in the impulsive and short duration regimes.

The work of the sections of the Conference enabled a large number of specialists to assemble according to the questions considered, and in spite of the limited time, to conduct a discussion of a series of significant problems. Valuable comments were expressed concerning questions of the organization of the scientific investigation works and statements were made for the arrangement of subsequent investigations.